

CLAIMS

What is claimed is:

1. A resorbable implant material for radiotherapy comprising:
 - (i) a resorbable base glass matrix which is biocompatible;
 - (ii) a radioactive isotope or combination of radioisotopes, wherein said radioisotope or combination of radioisotopes is incorporated or encapsulated directly and homogeneously into the base glass matrix during the process of manufacturing said base glass matrix, and wherein said base glass matrix does not need or require high energy particle irradiation to convert one or more stable isotopes into radioactive isotopes; and
 - (iii) an optional nitrogen-rich surface layer formed on the resorbable base glass matrix, the surface layer being of greater durability than the base glass matrix.
2. The resorbable implant material of claim 1, wherein said resorbable base glass comprises a silicate, borate or phosphate based matrix.
3. The resorbable implant material of claim 1, wherein said resorbable base glass matrix is a phosphate based matrix.
4. The resorbable implant material of claim 3, wherein said phosphate based matrix comprises phosphate in combination with calcium, zinc, iron, barium, sodium, strontium, magnesium, aluminum, gallium, indium, lithium, potassium, cesium, rubidium, or combinations thereof.
5. The resorbable implant of claim 3, wherein said phosphate based glass matrix comprises a calcium to phosphate ratio from about 0.33 to about 1.67.
6. The resorbable implant material of claim 1, wherein the implant material comprises image enhancing agents suitable for MRI, other imaging agents, diagnostic agents, or combinations thereof.
7. The resorbable implant material of claim 6, wherein the image enhancing agent is gadolinium, iron or combinations thereof.
8. The resorbable implant material of claim 3, wherein at least part of said phosphate based matrix contains a borate or silicate.

9. The resorbable implant material of claim 1, wherein the implant material contains selenium.
10. The resorbable implant material of claim 1, wherein said optional nitrogen rich surface layer comprises up to about 15 molar % nitrogen.
11. The resorbable implant material of claim 1, wherein said radioactive isotope or combination of radioisotopes is Y-90, In-111, Pd-103, P-32, Ce-131, Sm-153, Ho-166, Tc-99m, Yb-169, Au-198, Re-188, Re-186, Ir-192, Lu-177, Ba-140, Se-72, I-131, I-Tc-99m, Sr-90, Dy-165, Er, Tl, Sr, Gd, Y-90/In-111, Y-90/Tc-99m, P-32/In-111, P-32/Tc-125, Sr-90, Dy-165, Er, Tl, Sr, Gd, Y-90/In-111, Y-90/Tc-99m, P-32/In-111, P-32/Tc-125, Sr-90, Dy-165, Er, Tl, Sr, Gd, Y-90/In-111, Y-90/Tc-99m, Sm-153/In-111, Sm-153/Tc-99m, or combinations thereof.
12. The resorbable implant material of Claim 11, wherein said radioactive isotope or combination of radioisotopes is present in said base glass matrix in an amount effective for radiation synovectomy of arthritis.

13. The resorbable implant material of Claim 11, wherein said radioactive or combination of radioisotopes is present in said base glass matrix in an amount effective for radiation therapy of a tumor.
14. The resorbable implant material of claim 1, wherein said base glass matrix comprises up to 50 curies of total radioactivity from all isotopes.
15. The resorbable implant material of claim 1, wherein the resorbable base glass matrix is a particulate, microsphere, porous microsphere, hollow microsphere, microcapsule, fiber, short fiber, small rod, particulate dispersed in biopolymers, particulate dispersed in bioresorbable sutures, particulate dispersed in biocompatible gels a particulate dispersed in other media, or combinations thereof.
16. The resorbable implant material of claim 1, wherein said implant is a non-conductive implant.
17. The resorbable implant material of claim 16, wherein said non-conductive implant is radiographically detectable.
18. The resorbable implant material of claim 16, wherein said non-conductive implant is embedded in a non-conductive delivery vehicle.

19. The resorbable implant material of claim 18, wherein said non-conductive delivery vehicle is a biopolymer, bioresorbable suture, injectable gel, issue adhesive, other media, or combinations thereof.

20. The resorbable implant material of claim 19, wherein said biopolymer is poly-l-lactic acid in the molecular weight range of 30,000 to 500,000, poly-l-lactic acid copolymers with polyglycolic acid, polydioxanone (PDS II), polyglycaprone 25 (Moncyl), polyglactin 910 (Vicryl), phenyletheretherketone (PEEK), polysulfone (PSU), polyurethane, polypropylene, silicone, polyethylene terephthalate (PET), polyphenylene oxide blends (PPO), polyphenylsulfone (PPSU), polyether sulfone (PES), polyphenylene sulfide (PPS), polyetherimide (PEI), liquid crystal polymer (LCP), or combinations thereof.

21. A method of making a resorbable implant material containing a radioactive isotope comprising:

- (i) forming a base glass matrix;
- (ii) incorporating or encapsulating a radioisotope or combination of radioisotopes directly and homogeneously while forming said glass matrix; and
- (ii) optionally nitriding a surface of a biocompatible resorbable base glass matrix.

22. The method of claim 21, wherein radioisotope or combination of radioisotopes comprises a high energy pure alpha or beta emitter for radiotherapy and a gamma emitter for imaging or diagnostics.

23. The method of claim 22, wherein the high energy pure beta emitter is Y-90 or P-32 and the gamma emitter is In-111 or Tc-99m.

24. The method of claim 21, further comprising incorporating image enhancing agents suitable for MRI, other imaging agents, diagnostic agents, or combinations thereof.

25. The method of Claim 21, wherein said radioisotope or combination of radioisotopes are incorporated or encapsulated while forming said base glass matrix without melting bulk glasses.

26. The method of claim 21, wherein said forming of said base glass matrix comprises:

(a) dissolving all glass components in a solution;
(b) forming spherical dry powders of said solution; and
(c) solidifying said dry spherical powder into solid, porous or hollow microspheres, either in separate processing steps or in a continuous succession.

27. The method of claim 21, further comprising controlling drying parameters, solidification parameters, and microsphere classification parameters such that resultant porous or hollow microspheres have a density close to that of body fluid to be embolized and a dimension appropriate for embolizing body fluid passage leading to diseased tissues.

28. The method of claim 27, wherein said body fluid is blood.

29. The method of claim 27, wherein said density is between about 0.4 and 2.8 grams/mL.

30. ~~The method of claim 21, comprising embedding said base glass matrix in a delivery vehicle, wherein said vehicle is a biopolymer, bioresorbable suture, injectable gel, issue adhesives, other media, or combinations thereof.~~

31. A method of administering radiotherapy to a patient comprising inserting the implant of claim 1 into a patient at a site in need of radiotherapy.

32. The method of claim 31, wherein the site in need of radiotherapy is a joint, prostate, breast, liver, pancreas or other soft-tissue tumors.

33. The method of claim 31, wherein said implant material is suspended in a viscous medium.

34. The method of claim 33, wherein said viscous medium is pyrogen-free 85% glycerol or iodized lipiodol.

35. The method of claim 31, further comprising real-time monitoring.